

Notice of Allowability

Application No.

10/709,040

Examiner

Mehdi Namazi

Applicant(s)

PERCIVAL, JAMES I.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 5/13/2005.
2. ☒ The allowed claim(s) is/are 1-50, 52-56, 58-62, 88, 90-110 which have been renumbered as 1-81.
3. ☒ The drawings filed on 08 April 2004 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date 7/14/05; 5/13/05
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date 8/16/05.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

This office action is in response to amendment filed May 13, 2005.

Terminal Disclaimer

The terminal disclaimer filed on 8/17/2005 disclaiming the terminal portion of any patent granted on this application, which would extend beyond the expiration date of application No. 10/683,853, and any patent granted on application number has been reviewed and is accepted. The terminal disclaimer has been recorded.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Robert M. Asher (Reg. No. 30,445) on August 16, 2005.

The application has been amended as follows:

1. (currently amended) A computer network that comprises:
 - one or more I/O devices on which data may be stored in files; and
 - multiple computers coupled together, with each computer including a system memory having a plurality of caches with different bucket sizes created by cache software, wherein each of the multiple computers is configured to cache data from the one or more I/O devices in the plurality of caches, and
 - wherein each cache in the plurality of caches is capable of caching data from multiple files stored on the one or more I/O devices.
2. (original) The computer network of claim 1, wherein each cache in the plurality of caches stores data from multiple files.

3. (original) The computer network of claim 1, wherein the one or more I/O devices include at least one hard disk drive.
4. (original) The computer network of claim 1, wherein each computer is configured to cache said data in system memory using at least three caches with different bucket sizes.
5. (original) The computer network of claim 1, wherein additional computers may join the network, and wherein each of the multiple computers is configured to monitor which computers in the network are configured to cache said data.
6. (previously presented) The computer network of claim 5, wherein each of the multiple computers is configured to determine a remote connection address to only those other computers in the network that are configured to cache said data.
7. (original) The computer network of claim 6, wherein each of the multiple computers is further configured to send and receive targeted messages for maintaining cache coherency.
8. (original) The computer network of claim 5, wherein each of the multiple computers is further configured to determine a list of computers in the network that are configured to cache said data, and configured to update the list when additional computers join the network.
9. (currently amended) A computer network that comprises:
 - one or more I/O devices capable of storing data in a file; and
 - multiple computers coupled together, with each computer including a system memory having multiple caches with different bucket sizes created by cache software, and wherein each of the multiple caches is capable of caching data from said file.
10. (original) The computer network of claim 9, wherein each computer caches said data in system memory using at least three caches with different bucket sizes.
11. (original) The computer network of claim 9, wherein computers may join the network, and wherein each of said multiple computers monitors which computers in the network are configured to cache said data.

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12. (previously presented) The computer network of claim 11, wherein each of the multiple computers determine a remote connection address to only those other computers in the network that are configured to cache said data.

13. (original) The computer network of claim 12, wherein each of the multiple computers sends and receives targeted messages for maintaining cache coherency.

14. (currently amended) A computer program product comprising: at least one computer usable medium having a computer readable cache program thereon, the cache driver program to be executed by each of multiple computers coupled together in a network with at least one I/O device on which data may be stored in files, each of said multiple computers having an associated system memory, wherein the cache driver program comprises:

code to create in the associated system memory at least two caches having different bucket sizes, wherein each cache is capable of caching data from multiple files stored on said I/O device; and

a routine that configures the computer to use said caches to cache data from said I/O device into caches of suitable bucket size.

15. (currently amended) The cache driver program of claim 14, further comprising: code that configures the computer to maintain cache coherency by using targeted messages to invalidate remotely cached copies of data that has been modified.

16. (currently amended) The cache driver program of claim 14, further comprising: code that configures the computer to determine which computers in the network are configured to cache said data.

17. (currently amended) The cache driver program of claim 14, further comprising: code that configures the computer to determine a list of computers that are configured to cache said data, and further configures the computer to update the list after a computer that is configured to cache said data joins the network.

18. (currently amended) The cache driver program of claim 17, further comprising: code that configures the computer to determine a remote connection address for each computer in the list.

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19. (currently amended) The cache driver program of claim 14, wherein the at least one I/O device comprises at least one hard disk drive.

20. (currently amended) The cache driver program of claim 14, wherein the cache driver program configures each of the multiple computers to create in their associated system memory at least three caches having different bucket sizes.

21. (currently amended)) A computer program product comprising: at least one computer usable medium having a computer readable cache program thereon, the cache driver program to be executed by each of multiple computers coupled together in a network with at least one I/O device on which data may be stored in files, each of said multiple computers having an associated system memory, wherein the cache driver program comprises:

code to create in the associated system memory at least two caches having different bucket sizes, wherein each cache is capable of caching data from a given file stored on said I/O device; and

a routine that configures the computer to use said caches to cache data from said I/O device into a cache of suitable bucket size.

22. (currently amended) The cache driver program of claim 21, further comprising: code that configures the computer to maintain cache coherency by using targeted messages to invalidate remotely cached copies of data that has been modified.

23. (currently amended) The cache driver program of claim 21, further comprising: code that configures the computer to determine which computers in the network are configured to cache said data.

24. (currently amended) The cache driver program of claim 21, further comprising: code that configures the computer to determine a list of computers that are configured to cache said data, and further configures the computer to determine a remote connection address for each computer in the list.

25. (currently amended) A method of caching data on a network from a shared I/O device that is coupled to a computer that includes a system memory, wherein the shared I/O device stores said data in multiple files, wherein the method comprises:

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creating in system memory through use of cache software at least two caches with different bucket sizes; and
caching in each of the two caches data from multiple files stored on the shared I/O device.

26. (original) The method of claim 25, wherein the I/O device is a hard disk drive.

27. (original) The method of claim 25, wherein said creating includes creating three caches with different bucket sizes.

28. (previously presented) A method of caching data on a network from a file on at least one shared I/O device that is coupled to a computer having a system memory, wherein the method comprises:

creating in system memory at least two caches with different bucket sizes; and
caching in each of the two caches data from said file.

29. (original) The method of claim 28, wherein the at least one I/O device comprises a hard disk drive.

30. (original) The method of claim 28, wherein said creating includes creating three caches with different bucket sizes.

31. (currently amended) A computer network that comprises:

one or more I/O devices configured to store data; and
multiple computers coupled together, wherein each of the multiple computers is configured to cache said data and send targeted remote invalidate messages to only those computers configured to cache data stored on the I/O device to which the invalidate messages relate, and

wherein each of the multiple computers is configured to monitor which computers in the network are configured to cache said data.

32. (previously presented) The computer network of claim 31, wherein each of the multiple computers is further configured to determine a remote connection address for only those other computers in the network that are configured to cache said data.

33. (original) The computer network of claim 32, wherein each of the multiple computers is further configured to send and receive targeted messages for maintaining cache coherency.

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34. (original) The computer network of claim 31, wherein each of the multiple computers is further configured to determine a list of computers in the network that are configured to cache said data, and is still further configured to update the list when a computer that is configured to cache said data joins the network.

35. (original) The computer network of claim 34, wherein each of the multiple computers is further configured to determine a remote connection address for each computer in the list, and is still further configured to maintain cache coherency by communicating targeted messages among said multiple computers.

36. (original) The computer network of claim 31, wherein the one or more I/O devices include one or more hard disk drives.

37. (currently amended)) A computer program product comprising: at least one computer usable medium having a computer readable cache program thereon, the cache driver program to be executed by each of multiple computers coupled together in a network with at least one I/O device configured to store data, the cache driver program comprising:

- a routine that configures each of said multiple computers to cache said data from said at least one I/O device; and

- a program that configures each of said multiple computers (i) to monitor which computers in the network are configured to cache said data; and (ii) to send an invalidation message to only the nodes caching said data upon writing data to said at least one I/O device.

38. (currently amended) The cache driver program of claim 37, wherein the program further configures each of said multiple computers to determine a remote connection address for only those other computers in the network having said routine operable to cache said data.

39. (currently amended) The cache driver program of claim 38, wherein said routine further configures each of said multiple computers to send and receive targeted messages for maintaining cache coherency.

40. (currently amended) The cache driver program of claim 37, wherein the program further configures each of said multiple computers to:

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determine a list of computers in the network that are configured to cache said data;
and
update the list when a computer that is configured to cache said data joins the network.

41. (currently amended) The cache ~~driver~~ program of claim 40, wherein the program further configures each of said multiple computers to determine a remote connection address for each computer in the list; and wherein the routine further configures each of said multiple computers to maintain cache coherency by communicating targeted messages among said multiple computers.

42. (currently amended) The cache ~~driver~~ program of claim 37, wherein the at least one I/O device comprises a hard disk drive.

43. (currently amended) A method of caching, in a network having multiple computers and at least one I/O device, wherein each of the multiple computers has an associated system memory, wherein the at least one I/O device stores data, wherein the method comprises:

determining a list of computers in the network that are configured to cache said data;
updating the list when a computer joins the network;
determining a remote connection address for each computer in the list;
caching said data in the system memory of one or more of said multiple computers;
and
maintaining cache coherency by communicating targeted invalidation messages ~~among said multiple~~ to only those computers on the list for the data to which such message relates.

44. (original) The method of claim 43, wherein the at least one I/O device includes a hard disk drive.

45. (original) The method of claim 43, wherein said caching includes:

creating in each of the associated system memories at least two caches with different bucket sizes; and
caching in each of the two caches data from multiple files stored on the I/O device.

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46. (original) The method of claim 45, wherein said creating includes creating in each of the associated system memories three caches with different bucket sizes.

47. (original) The method of claim 43, wherein said data is a single file, and wherein said caching includes:

creating in each of the associated system memories at least two caches with different bucket sizes,

wherein each cache is capable of storing a portion of said data.

48. (previously presented) The method of claim 47, wherein said creating includes creating in each of the associated system memories three caches with different bucket sizes.

49. (previously presented) A computer network that comprises:

one or more I/O devices configured to store data; and

multiple computers coupled together, wherein each of the multiple computers is configured to cache data from the one or more I/O devices,

wherein each of the multiple computers is configured (i) to determine for each of the one or more I/O devices a list of computers in the network that are configured to cache data from that device and (ii) to maintain cache coherency among said multiple computers by communicating targeted messages based on the lists.

50. (original) The computer network of claim 49, wherein each of the multiple computers is further configured to determine a remote connection address for all other computers in each list.

51. (canceled)

52. (original) The computer network of claim 49, wherein each of the multiple computers is further configured to update the lists when a computer joins the network.

53. (currently amended)) A computer program product comprising: at least one computer usable medium having a computer readable cache program thereon, the cache driver program to be executed by each of multiple computers, wherein the multiple computers are coupled together in a network that includes multiple I/O devices, wherein the cache driver program configures each of the multiple computers to:

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determine for each of the multiple I/O devices a list of computers in the network that are configured to cache data from that I/O device;

send and receive targeted messages based on the lists to maintain cache coherency; and

update the lists when a computer joins the network.

54. (currently amended) The cache ~~driver~~ program of claim 53, wherein the cache ~~driver~~ program further configures each of the multiple computers to:

determine a remote connection address for each remote computer in the lists.

55. (currently amended) The cache ~~driver~~ program of claim 54, wherein the cache ~~driver~~ program further configures each of the multiple computers to:

establish a communications channel with each remote computer in the sets.

56. (currently amended) The cache ~~driver~~ program of claim 55, wherein the cache ~~driver~~ program further configures each of the multiple computers to:

enable communication of cache data invalidation messages via the communications channels.

57. (canceled)

58. (currently amended) The cache ~~driver~~ program of claim 53, wherein the I/O device is a hard disk drive.

59. (previously presented) A method of caching in multiple computers data from one or more I/O devices coupled to a network, wherein the method comprises:

determining for each of the one or more I/O devices a list of computers in the network that are configured to cache data from that I/O device;

maintaining cache coherency using the lists to send targeted messages; and

updating the lists when a computer joins the network.

60. (currently amended) The method of claim 59, further comprising:

determining a remote connection address for each remote computer in the lists.

61. (currently amended) The method of claim 60, further comprising:

establishing a communications channel with each remote computer in the lists.

62. (currently amended) The method of claim 61, further comprising:

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enabling communication of cache data invalidation messages via the communications channels.

63.-87 (canceled)

88. (currently amended) A computer network that comprises:

one or more I/O devices configured to store data; and multiple computers coupled together, wherein the multiple computers are each configured to cache a respective set of I/O devices selected from said one or more I/O devices, and wherein the sets are each independently changeable while caching operations are ongoing; wherein the multiple computers each include a system memory having a plurality of caches with different bucket sizes created by cache software.

89. (canceled)

90. (currently amended)) A computer program product comprising: at least one computer usable medium having a computer readable cache program thereon, the cache driver program capable of being installed on each of multiple servers clustered together in a network with a set of I/O devices configured to store data, the cache driver program comprising:

a cache software routine that configures the executing server to cache data from a subset of said I/O devices; and a procedure that configures the executing server to change the subset of said I/O devices while caching operations are ongoing wherein said cache software routine further configures the executing server to create in system memory at least two caches having different bucket sizes.

91. (currently amended) A method of caching in a network having multiple servers and multiple I/O devices, wherein each of the multiple servers has an associated system memory, and wherein the multiple I/O devices are each configured to store data, the method comprising:

caching on each of the multiple servers data from a respective set of said I/O devices wherein the caches on the multiple servers have multiple bucket sizes created by cache software; and

dynamically changing the set of I/O devices being cached by one of the multiple servers.

92. (previously presented) The method of claim 91, further comprising:

independently changing the set of I/O devices being cached by a different one of the multiple servers.

93. (previously presented) The method of claim 91, wherein said changing comprises including an additional I/O device in caching operations performed by said one of the multiple servers.

94. (previously presented) The method of claim 93, wherein said including an additional I/O device comprises notifying other servers with access to said additional I/O device that said one of the multiple servers is caching said additional I/O device.

95. (previously presented) A method of caching in multiple computers data from one or more information storage devices coupled to a network, wherein the method comprises:

constructing for each computer a set of all information storage devices accessible by that computer;

determining for each information storage device in each set a list of computers in the network that are configured to cache data from that information storage device for the purpose of sending targeted invalidation messages; and

reconstructing the lists after detecting a change in network configuration.

96. (previously presented) The method of claim 95, wherein the change in network configuration includes a computer joining the network.

97. (previously presented) The method of claim 95, wherein said constructing includes:

each computer identifying all computers in the network; and

each computer determining all information storage devices that it can access directly and all information storage devices it can access via other computers.

98. (previously presented) The method of claim 95, wherein said determining includes: enabling a selected computer's caching of data from a given information storage device;

notifying all computers with access to the given information storage device that the selected computer is configured to cache data from the given storage device.

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99. (previously presented) The method of claim 95, wherein said reconstructing includes:

- disabling caching on all computers in the network;
- individually enabling a selected computer's caching of data from a given storage device; and
- with each enabling operation, notifying all computers with access to the given information storage device that the selected computer is configured to cache data from the given storage device.

100. (previously presented) The method of claim 95, further comprising:

- caching data from one or more information storage devices in a system memory of one or more of said computers.

101. (previously presented) The method of claim 100, wherein said caching includes:

- creating in each of the associated system memories at least two caches with different bucket sizes; and
- caching in each of the two caches data from multiple files stored on the information storage device.

102. (currently amended) A computer network that comprises:

- one or more I/O devices; and
- multiple servers clustered together, wherein each of the multiple servers is configured to determine a set of all I/O devices accessible by that server, wherein each of the multiple servers is further configured to construct for each storage device in the set a list of servers that are configured to cache data from that I/O device for the purpose of sending targeted invalidation messages to only those servers on the list for any given I/O device, and wherein each of the multiple servers is further configured to reconstruct the lists after detecting a change in network configuration.

103. (previously presented) The computer network of claim 102, wherein the change in network configuration includes a server joining the network.

104. (previously presented) The computer network of claim 102, wherein as part of said constructing, each server is configured, as part of enabling caching for a given I/O

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device, to notify all servers with access to that given I/O device that the server is configured to cache data from that given I/O storage device.

105. (currently amended)) A computer program product comprising: at least one computer usable medium having a computer readable cache program thereon, the cache driver program that can be installed on, and executed by, each of multiple servers clustered together in a network that includes at least one information storage device, wherein the cache driver program configures each of the multiple servers to:
construct for each server a set of all I/O devices accessible by that server;
determine for each I/O device in the set a list of servers that are configured to cache data from that I/O device for the purpose of sending targeted invalidation messages to only those servers on the list for any given I/O device; and
reconstruct the lists after detecting a change in network configuration.

106. (currently amended) The cache driver program of claim 105, wherein the change in network configuration includes a server joining the network.

107. (currently amended) The cache driver program of claim 105, wherein as part of said constructing, the cache driver program configures each of the multiple servers to:
identify all servers in the network; and
determine all I/O devices that the server can access directly and all I/O devices that it can access via other servers.

108. (currently amended) The cache driver program of claim 105, wherein as part of said determining, the cache driver program configures each of the multiple servers to:
begin caching data from a given I/O device only after notifying all other servers with access to the given information storage device that the server is configured to cache data from the given storage device.

109. (currently amended) The cache driver program of claim 105, wherein as part of said reconstructing, the cache driver program configures each of the multiple servers to:
disable caching of all I/O devices; and
re-enable caching of a given I/O device only after notifying all other servers with access to the given I/O device that the server is configured to cache data from the given I/O device.

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110. (currently amended) The cache driver program of claim 105, wherein the cache driver program further configures each of the multiple servers to: cache data from one or more I/O devices in a system memory, wherein the caching includes creating in the system memory at least two caches with different bucket sizes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mehdi Namazi whose telephone number is 571-272-4209. The examiner can normally be reached on Monday-Friday 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mano Padmanabhan can be reached on 571-272-4210. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mehdi Namazi
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Mano Padmanabhan
8/22/05

MANO PADMANABHAN
SUPERVISORY PATENT EXAMINER